

## IMPLANTABLE BIOFUEL CELL SYSTEM BASED ON NANOSTRUCTURES

### ABSTRACT OF THE DISCLOSURE

**[0085]** A bio-implantable electrochemical cell system for active implantable medical devices. In one embodiment, the fuel cell includes an electrode structure consisting of immobilized anode and cathode enzymes deposited on nanostructured high-surface-area metal nanowires or carbon nanotube electrodes. The anode enzyme comprises immobilized glucose oxidase and the cathode enzyme comprises immobilized laccase. Glucose is oxidized at the surface of the anode and oxygen is reduced at the surface of the cathode. The coupled glucose oxidation-oxygen reduction reactions provide a self-generating current source. In another embodiment, the nanowires or carbon nanotubes, along with the adjacent surface anode and cathode electrodes, are coated with immobilized glucose oxidase and immobilized laccase containing biocolloidal substrates, respectively. This results in the precise construction of an enzyme architecture with control at the molecular level, while increasing the reactive surface area and corresponding output power by at least two orders of magnitude.